Department of
Environment &
Conservation

PAA for Wastewater Disinfection: What is Required in TN?

Ariel Wessel-Fuss - May 17, 2018

What is PAA?

- Paracetic Acid or Peroxyacetic Acid
- Typically sold as a mixture with Hydrogen Peroxide
- Formulations between 1% to upwards of 50%
- Biocidal oxidizer
- Used in the food industry as a sanitizer (both equipment and food)
- Cooling water additive
- Wastewater disinfectant

Benefits of PAA

- Does not produce the chlorine by products (trihalomethanes)
- Capital costs
- Safety considerations
- Lower freezing point and more stable than bleach or chlorine

Disadvantages of PAA

- More expensive
- PAA seems to be less effective for spores, viruses and protozoa (Giardia and Cryptosporidium)
- Can present an oxygen demand

Approval Process for Tennessee

- Tennessee does not have numeric water quality criteria.
- Bench-scale, partial pilot scale or full scale pilot test to determine the efficacy of the disinfection within the PAA concentration restriction imposed by the WET test results in the receiving stream using a specific **PAA formulation**
- We recommend you contact the division early in the process to understand the specific expectations.

Study Plan

- Pre-PAA discharge benthic macro-invertebrate survey or index *(Wadeable streams)*
- Whole (wastewater treatment plant) effluent toxicity (WET) test to determine toxic levels in the receiving water in accordance with state protocols,
- Test report and an NPDES permit modification/change request; and potentially;
- Post-PAA implementation discharge benthic macro-invertebrate survey or index. *(Wadeable streams)*

WET Testing

- Conduct a 7-day chronic toxicity test using spiked concentrations of reconstituted laboratory water to simulate the potential toxic effects of the manufacturer's product to a low flow stream. This should be set up using moderately-hard reconstituted water in a five concentration 0.5 dilution series with the No Observed Effect Concentration (NOEC) PAA and the corresponding hydrogen peroxide as the midpoint using Pimephales promelas and Ceriodaphnia dubia. Fresh dilutions should be prepared each day immediately prior to renewal of test chambers. Report the LC50 at 24, 48 and 96 hours as well as the IC25 and NOEC for survival and reproduction.

Develop a Monitoring Plan During Pilot

- Parameters
- Frequency
- Locations
- Sampling methods
- Analysis Protocols
- Results Submittal

Develop a Monitoring Plan During Pilot

- Outfall
  - Paracetic Acid
  - Hydrogen Peroxide
  - D.O.
  - BOD/CBOD
  - E. Coli
- Instream
  - Paracetic Acid
  - Hydrogen Peroxide

In Stream Bioassessment

- Conduct an instream bioassessment in early summer during a low-flow period. Submit the monitoring plan to the division for approval prior to conducting the instream bioassessment. The instream bioassessment will typically have a minimum of three instream sites: one upstream, one immediately downstream of outfall, and one farther downstream.
- Wadeable streams

Engineering Report

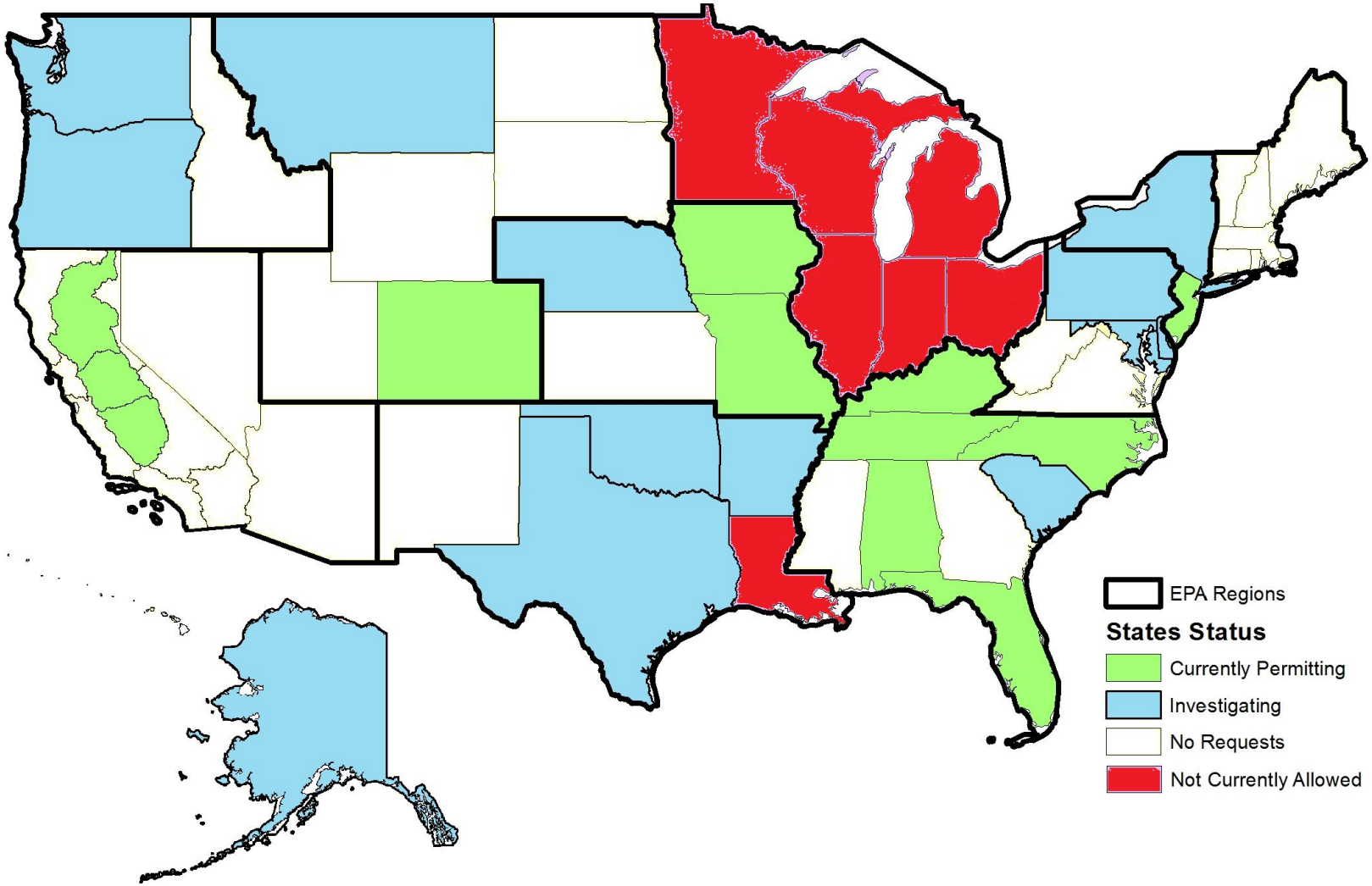
- **Results of the study are to be presented in an engineering report developed consistent with state design criteria pursuant to Rule 0400-40-02-01 et seq. The report is to:**

- a) Identify the objective of the process change,
- b) Identify how the final PAA system design achieves the objective,
- c) Identify (based on monitoring results) the level of degradation associated with the selected alternative (de minimus or more than de minimus)
- d) Discuss the social and economic consequences associated with measureable degradation that is more than de minimus
- e) Provide demonstration that the total residual oxidants in the effluent will not violate water quality standards, and
- f) Identify infrastructure changes needed for implementation and maintenance
- **In particular, the water quality demonstration must address the impact on ambient dissolved oxygen at toxic affects at stream low flow. The infrastructure considerations will need to address the corrosivity of PAA.**

What are the Limits?

- There is not currently a water quality criteria so limits are site specific based on the study results.
- Monitor and Report
  - Hydrogen Peroxide
  - Paracetic Acid
- We typically have used the IC25 toxic concentration for Paracetic Acid will generate a limit based on the dilution factor of the stream.
- The is a 1 mg/l limit published by the industries.

What Are Other States Doing?



What Are Other States Doing?

- Pilot Studies
- Mixing Studies
- Variations of WET testing
- Must Meet pH limits
- Variance committee

What Do Other States Say????

- Region 5
- Issues with CBOD
- Concern with effectiveness against spores, viruses and protozoa (Giardia and Cryptosporidium)
- Back up to UV
- Pennsylvania and Ohio are looking into developing a water quality criterion

Who Is Using It Now?

- Tullahoma, TN
- Lexington, TN
- St. Augustine, FL
- Flagler Beach, FL
- Hannibal, MO
- Denver, CO

Thank You!

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